
REVIEWS

Neuropsychological and Psychosocial Consequences of the COVID-19 Pandemic

P. Namdar,¹ N. A. Mojabi,² and B. Mojabi³

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The coronavirus disease designated as COVID-19 reached the level of a pandemic, affecting countries all across the world. Widespread outbreaks of COVID-19 are associated with psychological distress and symptoms of mental disorders. This article is a narrative review of the existing scientific literature on mental health of the society and interventions relevant to the COVID-19 pandemic. A search in the existing databases using the respective keywords has been carried out. It focuses on the consequences of the pandemic with respect to people's mental health in different clusters of society, including children, health care workers and their relatives, and pregnant women and their families. The unpredictability of the virus pandemic and its high transmission rate is an emergency of psychological problems and certain neuropsychological symptoms, such as fear and abnormal high anxiety, with respect to the spread of the disease, depression, avoidant behaviors, sleep disturbance, irritability, post-traumatic stress disorder (PTSD), pathological anger, and suicide cases.

Keywords: COVID-19, mental health, psychiatry, neuropsychology, psychosocial consequences, anxiety, depression, stress.

INTRODUCTION

The causative agent of COVID-19 disease is a new and genetically modified virus from the family of viruses called SARS-CoV-2. The new coronavirus SARS-CoV-2 was first identified in Wuhan, China, and expanded throughout the World.

The coronavirus pandemic has created a general medical crisis that requires an appropriate emergency response. This contagious disease is the largest outbreak since the severe outbreak of the *Severe Acute Respiratory Syndrome* (SARS). Symptoms of the virus disease vary from rather mild to severe and mortal. Usual signs and symptoms of infection include fever, cough, and difficulties in breathing related to pneumonia [1, 2].

The pandemic status of the COVID-19 disease has affected and, in many cases, paralyzed almost all essential economic, political, social, and even military aspects of all countries of the world. Discussion of the neuropsychological effects of this viral disease on the mental health of people at different levels of society is of a great importance. [3].

How people behave in an emergency depends on understanding and assessing the danger and the extent of their vulnerability. The high risk related of close person-to-person contacts (communication) plays an essential role in implementing precautionary behaviors and makes necessary a realistic understanding of risk, knowledge, and skills adequate for preventive measures [4, 5]. Estimates of pandemic-determined danger vary in different societies and cultures [6, 7].

Our knowledge of this disease is incomplete and is developing. Various coronaviruses are often known to combine mutations, posing an ongoing challenge to understanding the pathogenetic mechanisms of the disease and its clinical management. [8].

Abnormally high anxiety is a common symptom in the patients with chronic respiratory disorders;

¹ Social Determinant of Health Research Center, Research Institute for Prevention of Noncommunicable Diseases, Qazvin University of Medical Science, Qazvin, Iran.

² Science Research Center, Qazvin University of Medical Sciences, Qazvin, Iran.

³ Idaho State University College of Pharmacy, Pocatello, Idaho, USA. Correspondence should be addressed to P. Namdar (e-mail: drpeymannamdar99@gmail.com).

this phenomenon can significantly reduce the quality of life of the respective patients; almost all anxiety cases include sensory ones, which can overlap with the symptoms of a chronic respiratory disease *per se* and side effects of the drugs [9]. Clinical-level anxiety affects up to two-thirds of chronic respiratory patients and leads to decreased quality of life and physical exhaustion [10].

Anxiety disorders related to COVID-19 are common and seem to be mostly due to people's unknown and uncertain knowledge of this virus and the respective disease. Fear of the unknown reduces the perception of immunity in humans and has always caused anxiety for the latter. Scientific knowledge of COVID-19 also exacerbates this anxiety; the latter makes it difficult for people to distinguish right from wrong [11, 12]. Stress and anxiety can weaken the immune system and make the patients highly vulnerable to coronary heart disease [13]. Dealing with death during the coronavirus pandemic is also one of the most critical issues and has negative mental and physical health consequences [14].

During a pandemics, we can expect the emergence of various conspiracy theories and rumors about the source and/or cause of the infectious agent and vaccines (if any) used to prevent pandemics, and this increases the intensity of stress, anxiety, and other psychological problems in the community [15, 16].

There are many reasons why the outbreak of infectious diseases and the subsequent quarantine have devastating neuropsychological effects. This can, in turn, lead to feelings of tension, frustration, and anxiety [17].

In pandemic catastrophes, acute mental disorders characterized by disturbing risks are widespread and are more common in women than in men. Some of the evidence for fluctuations in the hormone levels is responsible for altering the sensitivity to emotional stimuli, which may form the basis of specific vulnerabilities to mental disorders over time and show a higher prevalence of subclinical arousal symptoms [18].

Due to the pathogenicity of the virus, rate of its spreading, and percentage of mortality caused by it, this disease may endanger the mental health of people prone to psychological disorders at different levels of society in different ways; Therefore, appropriate psychological strategies and techniques that can maintain the mental health of these people are essential [19, 20].

Psychological Effects of COVID-Related Quarantine on Mental Health

A quarantine is one of the most basic public health measures in the case of epidemics (pandemics). In order to protect public health, isolation and restriction of movements of people at a risk of infectious diseases to prevent infection of other people are usually applied [21–23]. Quarantine is different from isolation; in quarantine, the person appears healthy and stays in a center, while in isolation, he/she actually or supposedly sick are separated from other people [24, 25]. A timely quarantine reduces the economic costs of outbreaks [26, 27]. The quarantine process in the outbreak of coronavirus and its duration cause, however, “independent” considerable neuropsychological stress on people and may *per se* damage people's mental health and result in dramatic spreading of psychological disorders. The probable cause of these mental problems may be high anxiety about the disease possibility and fear of controlling it [28, 29]. Although most studies have found quarantine to be effective in controlling the disease, most people do not have good quarantine experience and oppose the respective forced quarantine [23, 30].

One of the most critical factors in the success of quarantine is the people's adherence to it. Enforcing strict quarantine without considering incentives and requests leads to the development of chaos and exacerbation of poor mental health; thus, the benefits of quarantine in maintaining public health justify its disadvantages [31].

According to the American Psychological Association, social distance leads to many signs of mental damage, such as emotional distress, depression, stress, irritability, sleep disturbance, disorders of the immune system, and cardiovascular disorders [23, 27, 32]. During the quarantine period, social isolation makes people more vulnerable to acute stress manifestations. People who have a mental illness before the pandemic can experience dramatic anxious thoughts and manifest obsessive behaviors [33–35]. It is one of the many psychological factors of health anxiety that affects how each person reacts to the coronavirus outbreak [36]. One of the most stressful conditions is the unpredictability of the situation, the uncertainty of disease control, and also the uncertainty of the quarantine duration [37, 38]. Studies have shown that the longer the quarantine period, the higher the percentage of psychological disorders and the greater the damage to mental health and

the avoidance of post-traumatic stress disorder (PTSD) symptoms and anger behaviors [38, 39].

In pandemic catastrophes, acute mental disorders characterized by disturbing risks are more common worldwide in women than in men. Furthermore, women have a higher prevalence of arousal symptoms [37]. It was also found that people quarantined for more than 10 days show significantly more intense post-traumatic stress symptoms than those quarantined for a shorter period [38].

The above psychological symptoms are expected to be more damaging in COVID-19, for which the minimum quarantine period is 14 days for the onset of the incubation period and also 14 days for the onset of the infection symptoms. The stressors are likely to decrease from the end of the quarantine period. What is enduring as a stressor is the patient label after the end of the quarantine period, the experience of being under others' supervision to continually check for signs and symptoms of the disease, anxiety, and irrationality of acquaintances from contacts with the person even though the person is not ill. This aggravates severe stress and anger [37–41].

Psychological Effects of COVID-19 Pandemic in Children

Due to a comparatively limited cognitive capacity in childhood, children gain most of their knowledge of the world around them with their parents' help. The family is an essential source of support and education. There is a significant relationship between maternal and child anxiety-related disorders [42–45].

The parent-child relationship is one of the protective factors against children's psychological and behavioral problems. Therefore, parents' anxiety and stress in their behavior will practically inevitably affect the level of psychological symptoms in children [44, 46–50].

According to some authors, COVID-19 disease is highly prevalent, which leads to increased parental stress and anxiety; this in turn increases the effects of stress and anxiety in some children [49, 50]. The prevalence of COVID-19 is an unprecedented event for all people, especially for children. Although children seem to be less vulnerable to the virus than adults, they are more susceptible to psychological problems and are intensely affected psychologically, showing behavioral problems. The most common psychological/behavioral problems among talkative

children are distraction and irritability. Poorly motivated anger and inattention are also severe COVID-19-related psychological symptoms in this age population [51, 52]. Due to the outbreak of COVID-19 disease and quarantine of children in the home environment and related news, the disease exposes them to large volumes of information, which makes them a subject to the experience of worry and anxiety and fear of losing parents.

School closures and home quarantine due to the disease outbreak can significantly affect children's physical and mental health. With the closure of schools and reduced social activities, interactions of the children with peers will decrease. This makes such decreased interactions with peers socially relevant [23, 53–58]. The relation of the COVID-19 pandemic and quarantine to such problems, as changes in the circadian rhythm (sleep patterns) and prolonged television viewing, is obvious [49, 54, 59].

As was found, children with ADHD (attention deficit/hyperactivity disorder) face, due to the closure of treatment centers and staying at home, serious problems related to physical control of acute stress and, in certain cases, drug problems [60, 61].

Following the closure of businesses at the height of the COVID-19 outbreak, which causes severe economic problems for some families, a decrease in the family satisfaction level will often lead to child abuse. Economic issues and family aggression affect the parent-child interaction cycle. So, some children experience a greater risk; in the absence of the safe home, interpersonal violence and dramatic child abuse may be observed [62].

At a young age, anxiety frequently causes depression and failure to achieve higher levels of education. Therefore, childhood and adolescence are ages with a high risk of anxiety disorder, while the rate of self-improvement is low. Moreover, this circumstance requires finding an adequate psychological support. Mental health problems in children can be related to unique complications and cause serious problems for the family and society [49, 63–65].

Psychological Effects of COVID-19 on Health Care Workers

Today, the outbreak of coronavirus is a significant challenge in most occupations, first of all, with respect to health care workers. People in such occupations are at the highest risk of contact with

the infection. Work-related stress in this case is a significant factor in causing mental disorders [35, 41, 66–68]. Increased daily stress is associated with mood swings. During an outbreak, health care workers are expected to work for abnormally long time intervals and with abnormal loading, under high pressure with insufficient resources and facilities. They accept the inherent dangers of close interaction with the patients. They are vulnerable to the disease *per se* and also to rumors and misinformation, which leads to increase in their level of anxiety; this anxiety intensifies when such people face the death of a colleague, while suffering from the disease [68, 69]. Lack of adequate sleep due to long working hours in the treatment staff causes depression, post-traumatic stress disorder, and anxiety-related disorders. Studies on the role of parental anxiety indicate an increase in the likelihood of anxiety disorder in children with anxious parents [44, 47, 70–74]. Family members of health care workers are also among personalities subjected to the highest risk of psychological disorders due to the spread of the virus and transmission of the disease to their family members [23, 75]. On the other hand, family members of medical staff may also experience some form of psychological disorder connected with the fear that family members may be infected with the virus by a staff member [75]. Also, family tension due to family blame for being in a high-risk job is one of the stressors for people working in the medical centers [76].

Constant stress is harmful to physical and mental health and causes a number of complications. Strong/long-lasting stresses negatively impact the individual and social coping mechanisms that they apply to reduce the individual's resistance. Negative effects of stress on the physical and mental states, the respective danger of the development of dysfunctions, and loss of adaptive abilities are obvious [77, 78].

Stress and high anxiety can weaken the immune system and make a person highly vulnerable to coronary heart disease. One of the main tasks of cognitive/behavioral therapy of the health care workers on reducing the physical symptoms of stress-related disorders is to help to reduce the anxiety level [79]. Since the work environment in the health care systems is highly stressful, training on how to manage negative thoughts can reduce anxiety and increase the quality of life of these people [80, 81].

The importance of psychological consequences is considered even greater than that of physical consequences, so that physical health falls in the group of mental and spiritual health of individuals [82, 83].

Medical and mental health of the medical staff, especially that of nurses, is directly affected by the quality of their performance in caring for patients. A high workload and insufficient personal protective equipment should be minimized to improve the physical and mental health of nurses, considering unique departmental demands [84, 85].

Psychological Effects of COVID on a “General Public”

The prevalence of psychological damage due to the spread of infectious diseases in society is highly significant. The emergence of coronavirus has dramatically changed people's living conditions and has had devastating psychological effects (first of all high anxiety). Anxiety about this virus (COVID-19) is common and seems to be due, to a significant extent, to its unknown features. Fear of the unknown always causes high anxiety in human beings [86–88]. Anxiety refers to a condition in which a person is overly concerned about what might happen in the future. Anxious behaviors can appear natural adaptive reactions that help the person to respond appropriately to difficult situations, but severe anxiety can cause mental problems and maladaptive behaviors [89, 90].

The prevalence of CORONA and quarantine increases psychological disorders and reduces the tolerance threshold. People have seen this increase in contradictions and conflicts; domestic violence has increased tensions between spouses, so that some couples can no longer tolerate each other. Some people begin to hate each other more the more time they spend together. This applies not only to couples but also to other family members [23, 39, 91].

The result of the very high prevalence of this disease is the filling of hospital beds, extreme fatigue of the treatment team, and negative results of home quarantine, all of which can cause adverse psychological effects in the community.

Fear of illness and death and dissemination of false news and rumors, interference in daily activities, restrictions to travels and transit, curtailment of “usual” social relations, and occurrence of job and financial problems consequently increase the

psychological burden and pressure on families.

Children are likely to be experiencing worry, anxiety, and fear, and this can include the types of fears that are very similar to those experienced by adults, such as a fear of dying, a fear of their relatives dying, or a fear of what it means to receive medical treatment [92, 93]. If schools have closed as a part of necessary measures, then children may no longer have that sense of structure and stimulation provided by the environment; now they have less opportunities to be with their friends and get that social support, which is essential for mental well-being.

Having a history of mental health problems before the spread of infectious diseases and some personality traits acts as aggravating factors during quarantine; thus, some stressors are of an individual nature.

People who suffer from depressive and anxiety disorders before the outbreak of infectious diseases experience stressors more severely and have less sufficient coping skills to manage those, and the severity of their psychological symptoms increases [94].

Sometimes people worry about anticipating post-quarantine conditions. Leaving work without any plans to improve leads to socio-economic turmoil, followed by mental illness and post-traumatic stress disorder, anxiety, and depression. High anger may come after leaving this period [95, 96].

Studies have also shown that the rise of infectious diseases and the world's perception as a scary and unstable place leads to intensified spreading of conspiracy theories. The respective theories may be more prevalent in people with emotionally vulnerable factors, such as anxiety and intolerance [97–99]. Stressors, such as prolonged quarantine, fear of infection, frustration, boredom, insufficient information resources, and financial loss, cause mental disorders in the general population [100].

Psychological Effects of COVID-19 on Pregnant Women

Pregnant women constitute another high-risk group in the general population. Due to the prevalence of the disease, pregnant women are more vulnerable, which increases the level of anxiety and stress in this contingent.

Little information is available on the impact of this disease on pregnancy. Due to the importance of maternal and neonatal health in general community health, COVID prevention, diagnostics, and treat-

ment of pregnant women are of particular interest.

Because the mother's emotional states and anxiety significantly affect the growth of the fetus, shifts in the emotional state of pregnant women strongly affect the mother's nervous system. Stress-related release of such agents as acetylcholine and epinephrine, which are transferred to the fetus through the placenta, increase fetal movements. If the mental pressure and anxiety are long-lasting, the fetal movements become more intense, and the baby can be born prematurely with a low weight. Complications, such as anemia, hyperactivity, and high irritability, are frequently seen in children born of "epidemic" stress-affected mothers. Serious complications, such as cerebral palsy, learning disabilities, and other disabilities, may be manifested with a high probability in the respective contingent of offspring [101, 102].

Epidemic-related stressors during pregnancy endanger a person's mental health in both childhood and adulthood. There is a clear correlation between the cortisol in blood plasma of the pregnant women and their anxiety level, so that this hormone is secreted more intensely in anxious mothers. There is also a direct relationship between maternal anxiety and fetal brain development abnormalities [103].

Alterations in the immune system in pregnant women also can cause health complications in newborns. ACE2 is a receptor for the coronavirus in lung cells. Increased expression of this receptor in pregnant women increases their sensitivity to COVID-19. On the other hand, increased production of anti-inflammatory cytokines (interleukin-4 and interleukin-10) reduce the severity of COVID disease [104, 105]. Some mothers do not have regular checkups for fear of developing COVID-19, while others want to terminate the pregnancy quickly by Cesarean section [106, 107].

Due to the negative psychological consequences of the COVID-19 pandemic, it is essential to design and plan interventions and supportive strategies to reduce the adverse effects of this dramatic factor.

Pandemic-related rumors have a devastating effect on people's mental health. It is obvious that psychiatrists play a highly essential role during COVID-19 pandemic. The psychiatrist can educate the public about the common psychological effects of a pandemic, motivate the public to adopt strategies for disease prevention and health promotion, integrate their services with available health care, teach problem-solving strategies to cope

with the current crisis, empower COVID-19 patients and their caregivers, and provide mental health care to healthcare workers involved in the fight against the pandemic.

Adequate and reliable public education about the pandemic is essential. Ideally, the respective information should guide how to manage stress when taking on new roles in the family, and this will help to avoid dangerous consequences of grief, depression, anxiety, and persistent frustration and anger [34, 108].

Fatigue is one of the symptoms and consequences of intense stress and high anxiety. Therefore, in most cases, anxiety is reported by those who feel chronic fatigue and lethargy. Thus, effective cognitive and behavioral therapy may reduce the fatigue symptoms [109]. This methodic treatment approach directly affects the three components of anxiety, namely the behavioral intellectual component, the anxiety level *per se*, and the modification of beliefs [110].

Training with the use of cognitive-behavioral therapy methods positively reduces people's mental health problems, especially in high-risk people. Therefore, healthcare officials must educate this contingent to identify the above psychological disorders in vulnerable people and provide mental programs and protocols to treat and protect the population's mental health.

One of the most critical stressors during an epidemic is insufficient, inadequate, or distorted information. In the case of the COVID-19, its very high transmission rate has created an emergency in global health, which results from the onslaught of anxiety and changes in the lifestyle of people with psychological diseases.

Therefore, in the case of COVID-19, more knowledge should be made available about this new virus and its spread. This will make it possible to more effectively deal with it. Of course, with the reduction of stress and anxiety caused by the pandemic, we will face fewer psychological problems. Maintaining the mental health of people is essential and inevitable.

This is a review paper; thus, confirmation of its correspondence to the existing ethical standards for experimental works is not necessary.

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